

## REMARKS

This paper is being presented in response to the final official action dated March 9, 2005, wherein: (a) claims 1-18 are pending; (b) claims 1-16 have been rejected under 35 USC § 112, ¶ 1, as allegedly failing to comply with the written description requirement; (c) claims 1-13, 15, and 18 have been rejected under 35 USC § 102(b) as being anticipated by Hasche U.S. Patent No. 2,844,452 (the "Hasche '452 patent"); (d) claims 14 and 16 have been rejected under 35 USC § 103(a) as being obvious over the Hasche '452 patent in view of Hasche U.S. Patent No. 2,845,335 (the "Hasche '335 patent"); and, (e) claim 15 has been rejected under § 103(a) as being obvious over the Hasche '452 patent in view of the Hasche '335 patent as applied to claim 14, and further in view of Brophy et al. U.S. Patent No. 4,767,569 (the "Brophy patent"). Reconsideration and withdrawal of the rejections set forth in the action are respectfully requested in view of the following remarks.

This paper also is being presented in accordance with 37 CFR § 1.116(b)(1) and (b)(2) in an effort to place the application in condition for allowance or in better condition for consideration on appeal. No amendments are being presented herein. The arguments presented herein were not presented in prior communications to the U.S. Patent and Trademark Office ("PTO") due to the applicants' good faith belief that all prior rejections had been overcome by amendment and/or argument.

This paper is timely filed as it is accompanied by a petition under 37 CFR § 1.136(a) for an extension of time to file in the first month, and payment of the required extension fee.

### **I. The 35 USC § 112, ¶ 1, Rejection is Traversed**

Claims 1-16 have been rejected under 35 USC § 112, ¶ 1, as allegedly failing to comply with the written description requirement. *See* the Action at pp. 2-3. A response to the rejection is set forth below.

#### **A. Proper Basis for a § 112, ¶ 1, Written Description Rejection**

To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail such that a person having ordinary skill in the art, as of the specification's effective filing date, could have reasonably concluded that the patent applicants had possession of the claimed invention. *See, e.g., Moba, B.V. v. Diamond Automation, Inc.*, 325 F.3d 1306, 1319 (Fed. Cir. 2003). Patent applicants show possession of the claimed invention by providing a specification describing the claimed invention with all of its features using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention. *Lockwood v. American Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997). While there is no *in haec verba* requirement, claims amended during prosecution must be supported in the specification through express, implicit,

or inherent disclosure. Amended claims that introduce subject matter not supported by the filed specification violate the written description requirement. *See, e.g., In re Lukach*, 442 F.2d 967 (CCPA 1971). The fundamental inquiry is whether the filed specification conveys with reasonable clarity to those having ordinary skill in the art that, as of the specification's filing date, the applicants were in possession of the claimed invention. *See, e.g., Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 1563 (Fed. Cir. 1991).

As set forth in MPEP § 2163(II)(A) (8th ed. rev. 2, May 2004), the PTO bears the burden, after a thorough reading and evaluation of the contents of the application, of presenting evidence or reasons why a person having ordinary skill in the art would not recognize that the specification describes the claimed invention. There is a strong presumption that an adequate written description of the claimed invention is present in the specification as filed, *see In re Wertheim*, 541 F.2d 257, 262 (CCPA 1976); however, with respect to amended (or newly-added) claims, patent applicants should show support in the original disclosure for the new or amended claims.

#### **B. The Specification Sufficiently Describes the Claimed Invention**

The specification provides a written description of the presently-claimed invention in compliance with § 112, ¶ 1. The text of claim 1 is reproduced above. The claimed method includes "heating the reactant mixture in the heated reaction zone from a temperature less than the superadiabatic combustion temperature to a temperature sufficient to result in a superadiabatic combustion." Support for such heating is found throughout the specification. Specifically, and as cited in the prior response, support can be found at, for example, page 8, lines 21-25:

[T]he method includes the step of flowing the reactant mixture through a heated zone (e.g., porous fixed-bed) of a reactor at a speed ( $u(t)$ ). The porous, fixed-bed (or solid phase) serves as an intermediate for heat accumulation and regeneration. The reactor operates at a temperature sufficient to result in a SAC [superadiabatic combustion] of the reactant mixture.

The action, however, takes the position that the passage quoted above does not support the recited claim language *because* "it does not provide support for the step of heating the reactant mixture in the heated reaction zone from a temperature less than the superadiabatic combustion temperature to a temperature sufficient to result in a superadiabatic combustion." The Action at p. 3. The action merely states a conclusion without foundation.

The action cites to page 14, lines 3-22, and page 16, lines 8-13, of the specification, suggesting that the cited passages teach something other than the claimed invention. As a preliminary matter, the cited passages describe *examples* of suitable reactors that can be

used to carry out the claimed method — these are not the only reactors that can be used to carry out the claimed method:

The process of coupling the transient thermal wave ( $u(t)$ ) to the flow of reactant mixture ( $v(t)$ ) to obtain SAC can be carried out in a variety of reactors. *Examples* of such suitable reactors are illustrated in FIGS. 1 and 2, wherein like reference numbers represent identical or similar features in the various views.

See the Specification at page 11, lines 1-5 (emphasis supplied). The claimed invention is not limited to the portions of the specification cited in the action. The specification provides ample support for reactors containing apparatus for heating portions of the fixed-bed reaction zone to a temperature sufficient to sustain superadiabatic combustion of the reactant mixture:

Suitable apparatus for carrying out the combustion can include a thermally-insulated reactor containing a porous, fixed-bed, the reactor having an inlet and an outlet. The apparatus can also include an initial means for heating a specific portion of the fixed-bed to a temperature sufficient to sustain a SAC of the reactant mixture and means for reversing a direction of flow of the reactant mixture and the product (the heat generated by combustion) inside the reactor.

See the Specification at page 9, lines 6-12.

Contrary to the action's suggestion, both passages in the specification to which the action cites *support* the claimed method. Both of the cited passages disclose — and even the summaries thereof in the action (at p. 3) recognize — that incoming reactants are heated using heat accumulated in the SAC zone of the reactor. Indeed, to conclude otherwise would be inconsistent with the disclosed method. Specifically, if the incoming reactants were already at or above the SAC temperature, then the SAC would have initiated upstream of the SAC zone. However, these portions of the specification quite clearly disclose that the incoming reactants are heated “to raise the temperature within the combustion zone [ ] to a temperature sufficient to initiate a reaction (i.e., self-ignition combustion temperature), the fuel-rich reactant mixture is flowed into the reactor where a combustion occurs, generating a wave of heat and combustion products.” See the Specification at p. 13, lines 3-7; *see also*, the Specification at page 14, lines 9-12. Thus, the cited passages and drawing figures referred to in those passages provide written description of the presently claimed method in accordance with § 112, ¶ 1.

The action also overlooks other passages in the specification that sufficiently support the claims:

The reactant mixture exits the first end of the tube 104 and enters the zone 16 which has been heated by heating means 18, such as an electric heater, or other energy source, to a

temperature sufficient to initiate the SAC.

Once the reaction is initiated, the reaction is self-sustaining as additional reactant mixture is introduced to zone 16 through tube 104. The reaction products exit CFR [counterflow reactor] 100 through the annular space between the vessel 102 and the tube 104. The hot reaction products transfer heat to incoming reactant mixture within the tube 104 as the products exit the CFR 100. In the CFR 100, heat transfer efficiencies of about 40% have been demonstrated.

See the Specification at page 16, lines 4-13.

The foregoing arguments and cited passages in the specification demonstrate that the applicants "possessed" the claimed invention when they filed their application. *See Moba*, 325 F.3d at 1319; *Lockwood*, 107 F.3d at 1572. It is respectfully submitted that the application as filed includes a written description of the invention recited in the pending claims in compliance with § 112, ¶ 1, such that the rejection, upon reconsideration, should be withdrawn. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

## **II. The 35 USC § 102(b) Rejection is Traversed**

Claims 1-13, 17, and 18 have been rejected under 35 USC § 102(b) as being anticipated by the Hasche '452 patent. *See the Action at pp. 3-5.* A response to the anticipation rejection is set forth below.

### **A. Proper Basis for a § 102(b) Rejection**

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987). Thus, a determination that a claim is anticipated under 35 USC § 102 involves two analytical steps. First, the PTO must interpret the claim language, where necessary, to ascertain its meaning and scope. In interpreting the claim language, the PTO is permitted to attribute to the claims only their broadest *reasonable* meaning as understood by persons having ordinary skill in the art, considered in view of the entire disclosure of the specification. *See In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997). Second, the PTO must compare the construed claim to a single prior art reference and set forth factual findings that "each and every limitation is found either expressly or inherently [disclosed] in [that] single prior art reference." *Celeritas Techs. Ltd. v. Rockwell Int'l Corp.*, 150 F.3d 1354, 1360 (Fed. Cir. 1998). Additionally, "[t]he identical invention must be shown in as complete detail as is contained in the patent claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236 (Fed. Cir. 1989).

**B. The § 102(b) Rejection is Traversed**

Independent claim 1 recites a heated reaction zone containing a porous fixed bed and also recites that the reactant mixture is combusted in the reaction zone. Contrary to the statements at page 4 of the action, the Hasche '452 patent does not disclose any of these features. Instead, the Hasche '452 patent teaches the combustion of reactants in a combustion space *devoid* of a porous fixed bed, i.e., a conventional combustion chamber:

The heated combustible material then passes into combustion space 8 where it burns.

See the Hasche '452 patent at col. 7, lines 33-34, and Fig. 1. Nowhere in the Hasche '452 patent is there a disclosure or suggestion of performing any combustion, much less superadiabatic combustion, in a porous fixed bed. Because the Hasche '452 patent does not disclose each and every limitation recited in the pending claims, the Hasche '452 patent does not anticipate the pending claims. *Richardson*, 868 F.2d at 1236 ("The identical invention must be shown in as complete detail as is contained in the patent claim.").

The Hasche '452 patent (as well as the Hasche '335 patent and the Brophy patent) utilizes heat exchangers upstream and downstream of the combustion space. The upstream heat exchanger heats incoming reactants, while the downstream heat exchanger cools the combustion products. While those heat exchangers may utilize porous packing material, they need not — those heat exchangers could be replaced by any of a variety of known heat exchangers (e.g., heating elements, condensers, etc.). The mere presence of a porous material in the heat exchanging portions of the reactor have no relevance to the invention recited in the pending claims. Importantly, none of the reactors disclosed in these patents contains a combustion space packed with a porous fixed bed. Consequently, the claimed invention is not anticipated by the Hasche '452 patent (and also is not anticipated by any of the other applied prior art publications).

Reconsideration and withdrawal of the § 102(b) rejection are respectfully requested.

**III. The 35 USC § 103(a) Rejection is Traversed**

Claims 14 and 16 have been rejected under 35 USC § 103(a) as being obvious over the Hasche '452 patent in view of the Hasche '335 patent. See the Action at pp. 5-6. Claim 15 has been rejected under § 103(a) as being obvious over the Hasche '452 patent in view of the Hasche '335 patent as applied to claim 14, and further in view of the Brophy patent. See the Action at pp. 6-7. A response to the obviousness rejection is set forth below.

**A. Proper Basis for a § 103(a) Rejection**

The PTO "has the burden under § 103 to establish a prima facie case of obviousness." *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988). To establish a prima facie case of obviousness, the PTO must satisfy three basic criteria. First, the PTO must show that

the combined disclosure of the prior art references teaches or suggests all of the claim limitations. See MPEP § 2143 (8th ed., May 2004). Moreover, it is “incumbent upon the examiner to identify wherein each and every facet of the claimed invention is disclosed in the applied reference.” *Ex parte Levy*, 17 USPQ2d 1461, 1462 (Bd. Pat. App. & Inter. 1990).

Second, where obviousness is alleged to arise from a combination of elements across a plurality of references, the PTO must show the existence of some suggestion, motivation, or teaching to those skilled in the art to make the precise combination recited in the claims. See *Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1320 (Fed. Cir. 2004). Compliance with this requirement prevents the PTO’s use of “the inventor’s disclosure as a blueprint for piecing together the prior art to defeat patentability — the essence of hindsight.” *Ecolochem, Inc. v. Southern Cal. Edison Co.*, 227 F.3d 1361, 1371-72 (Fed. Cir. 2000) (quoting *In re Dembiczak*, 175 F.3d 994, 999 (Fed. Cir. 1999)). Evidence of a suggestion or motivation to combine prior art references may come from “the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved.” *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1125 (Fed. Cir. 2000). The PTO’s showing “must be clear and particular, and broad conclusory statements about the teaching of multiple references, standing alone, are not ‘evidence.’” *Id.* (quoting *In re Dembiczak*, 175 F.3d at 1000). Indeed, the U.S. Court of Appeals for the Federal Circuit has consistently held that a person having ordinary skill in the art must not only have had some motivation to combine the prior art teachings, but also some motivation to combine the prior art teachings in the particular manner claimed. See, e.g., *In re Kotzab*, 217 F.3d 1365, 1371 (Fed. Cir. 2000) (“Particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed.”).

To support a conclusion that a claimed combination is *prima facie* obvious, either (a) the references must expressly or impliedly suggest the claimed combination to one of ordinary skill in the art, or (b) the PTO must present a convincing line of reasoning as to why a person of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. See *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985); see also, *In re Rinehart*, 531 F.2d 1048, 1051 (CCPA 1976). The mere fact that the prior art could be modified as proposed by the PTO is not sufficient to establish a *prima facie* case of obviousness. See *In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992). The PTO must explain why the prior art would have suggested to one of ordinary skill in the art the desirability of the modification. *Id.*; *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998) (“In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed.”).

Finally, the PTO must demonstrate that a person having ordinary skill in the art would have a reasonable expectation of success when combining the disclosures of the references. The suggestion or motivation to make the claimed invention and the reasonable expectation of success must both be found in the prior art, and must not be derived by hindsight from knowledge of the application's disclosure. *In re Dow Chem. Co.*, 837 F.2d 469, 473 (Fed. Cir. 1988); MPEP § 2143.

**B. No Prima Facie Case of Obviousness Has Been Made  
and, therefore, the § 103(a) Rejection is Traversed**

The Hasche patents *do not* teach or suggest all of the limitations recited in claims 14 and 16. Furthermore, the Hasche patents in combination with the Brophy patent *do not* teach or suggest all of the limitations recited in claim 15. Thus, no prima facie case of obviousness has been made in the instant action, and none exists based on the combination of the applied publications.

This paper identifies evidence (i.e., deficiencies in the disclosure of the Hasche '452 patent) demonstrating that the Hasche '452 patent does not teach or disclose all of the limitations recited in independent claim 1 and the claims that depend from claim 1. See Section II.B, above. Those arguments and demonstrative evidence are incorporated herein in response to the § 103(a) rejection.

Each of claims 14-16 depend directly or indirectly from claim 12, which itself depends from claim 1. Contrary to the statements at pages 5-7 of the action, the Hasche '452 patent does not disclose or teach all of the limitations recited in independent claim 1. For example, the Hasche '452 patent teaches the combustion of reactants in a combustion space *devoid* of a porous fixed bed, i.e., a conventional combustion chamber. The deficiencies in the disclosures of the Hasche '452 patent are not remedied by either of the Hasche '335 patent or the Brophy patent. None of the applied prior art publications discloses a reaction zone containing a porous fixed bed as recited in each and every one of the pending claims. Because the applied prior art when taken together do not even disclose all of the features recited in independent claim 1, they cannot possibly disclose all of the features recited in any of the dependent claims (e.g., dependent claims 14-16). Absent a disclosure of all of the features recited in the pending claims, the applied prior art does not render the claims prima facie obvious. Consequently, the § 103(a) rejections of claims 14-16 are traversed.

The pending claims recite methods of continuously generating combustion products from a fuel-rich reactant mixture utilizing a heated reaction zone of a reactor, where the zone and reactor contain a porous fixed bed. The heated reaction (combustion) zone resides within the porous bed and is influenced by the properties of the material of the porous bed. The combustion zone *is not a separate conventional gas phase burner* positioned between two separate porous beds (e.g., see the applied prior art publications); instead, the

combustion zone moves within the porous bed and establishes a diffuse combustion zone as it moves back and forth in the bed with the switching of the flow direction. When catalytic materials are employed in the bed, the combustion process results in heterogeneous reactions on the surface of the bed material — reactions that are not even possible in the conventional combustion spaces described in the prior art publications — *coupled* with gas-phase reactions. Even when *non-catalytic materials* are employed in the bed, the surface properties of the bed material influence the reactions through its thermal radiation, their thermal conductivity, and formation of local flow eddies. The presence of a packed fixed bed in the zone where combustion occurs also provides process control advantages not possible with the combustion spaces described in the prior art publications. Specifically, in the packed fixed bed, the combustion is spread over a finite length of the bed, which provides a longer time-period in which to carry out the combustion. That longer time period provides for flexible residence times not achievable in the combustion spaces described in the prior art publications and also provides the ability to better control the reaction and the yields obtained therefrom. Thus, the presence of a packed fixed bed in the zone where combustion occurs patentably distinguishes the claimed method from the disclosures in the applied prior art publications (taken alone or in combination).

Given the shortcomings in the prior art, it is respectfully submitted that the claimed invention is unobvious. Accordingly, reconsideration and withdrawal of the § 103(a) rejections are respectfully requested.

Prima facie obviousness under § 103 is a legal conclusion — not a fact. *In re Rinehart*, 531 F.2d at 1052. The foregoing response identifies facts (e.g., evidence in the form of statements/deficiencies in the applied prior art) rebutting the alleged legal conclusion that the claimed invention is prima facie obvious. All of these facts must be evaluated along with the facts on which the legal conclusion was originally reached — not the legal conclusion itself. Having requested herein reconsideration of the legal conclusion set forth in the official action, the PTO is obligated to address all of the evidence and base its forthcoming legal conclusion(s) on such evidence, uninfluenced by its earlier conclusions. *Id.*



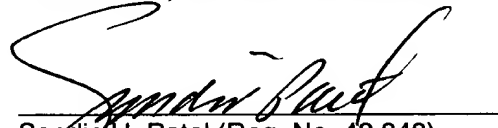
### CONCLUSION

In view of the foregoing, reconsideration and withdrawal of the rejections, and allowance of all pending claims 1-18 are respectfully requested.

Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, the examiner is urged to contact the undersigned attorney.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read "Sandip H. Patel", is written over a horizontal line.

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